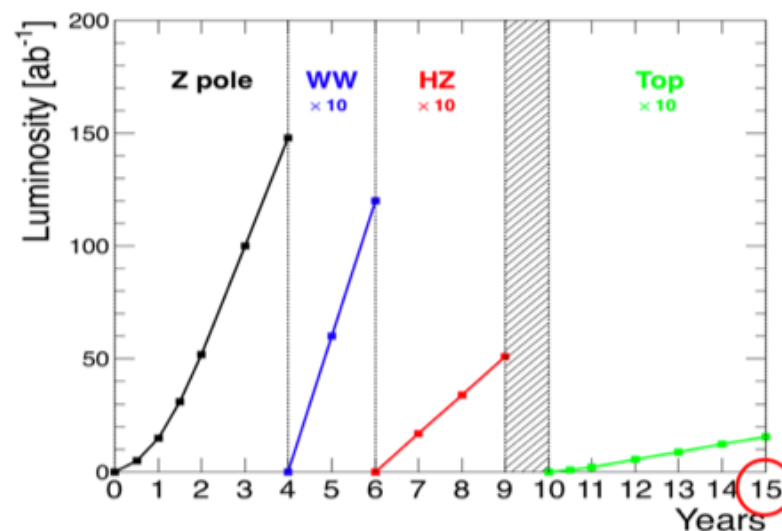
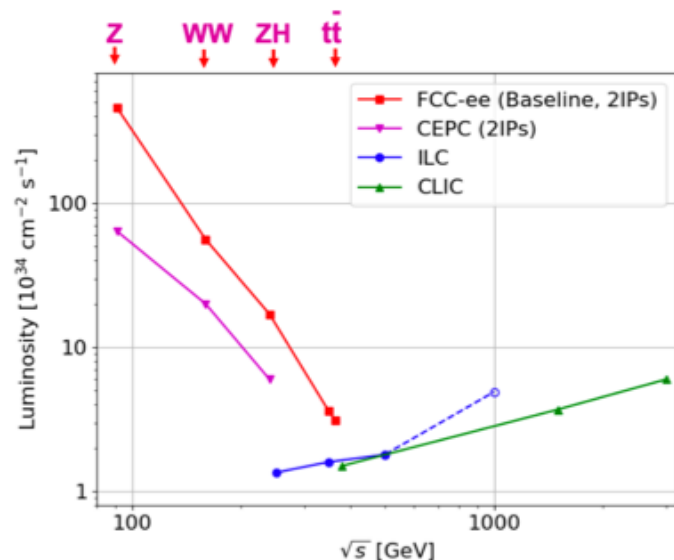


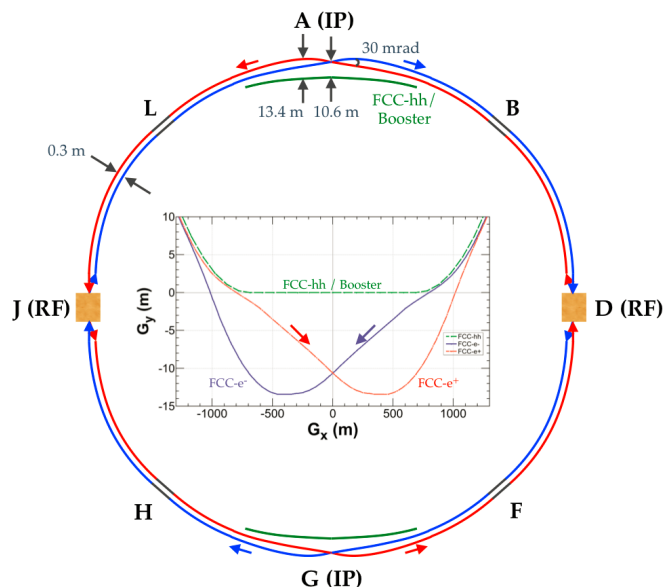
CERN post-LHC project FCC-ee: Ultimate luminosity e^+e^- collider in 88 – 365 GeV range



Factory for Z, W, Higgs, top, heavy flavour

$5 \times 10^{12} e^+e^- \rightarrow Z$
 $10^8 e^+e^- \rightarrow W^+W^-$
 $10^6 e^+e^- \rightarrow HZ$
 $10^6 e^+e^- \rightarrow t\bar{t}$

$3 \times 10^{11} \tau$ decays
 $1.5 \times 10^{12} b$ quarks



FCC-ee parameters		Z	W^+W^-	ZH	$t\bar{t}$
\sqrt{s}	GeV	91.2	160	240	350-365
Luminosity / IP	$10^{34} \text{ cm}^{-2} \text{ s}^{-1}$	230	28	8.5	1.7
Bunch spacing	ns	19.6	163	994	3000
"Physics" cross section	pb	40,000	10	0.2	0.5
Total cross section (Z)	pb	40,000	30	10	8
Event rate	Hz	92,000	8,400	1	0.1
"Pile up" parameter $[\mu]$	10^{-6}	1,800	1	1	1

From experimental point of view, conditions most challenging at Z-pole:

- 50 MHz BX rate
 - Continuous beam, no power pulsing
- Physics rate of ~ 100 kHz
 - Physics event in 1 out of ~ 500 BX
 - Must be all recorded and kept for analysis
- Aim for $\sim 10^{-5}$ precision to match statistics

T/DAQ: How do we trigger and read out detectors? **Basic questions, no answers yet**

Overarching goal: Cross-section measurements to $\mathcal{O}(10^{-5})$ precision

Trigger philosophy (as at LEP):

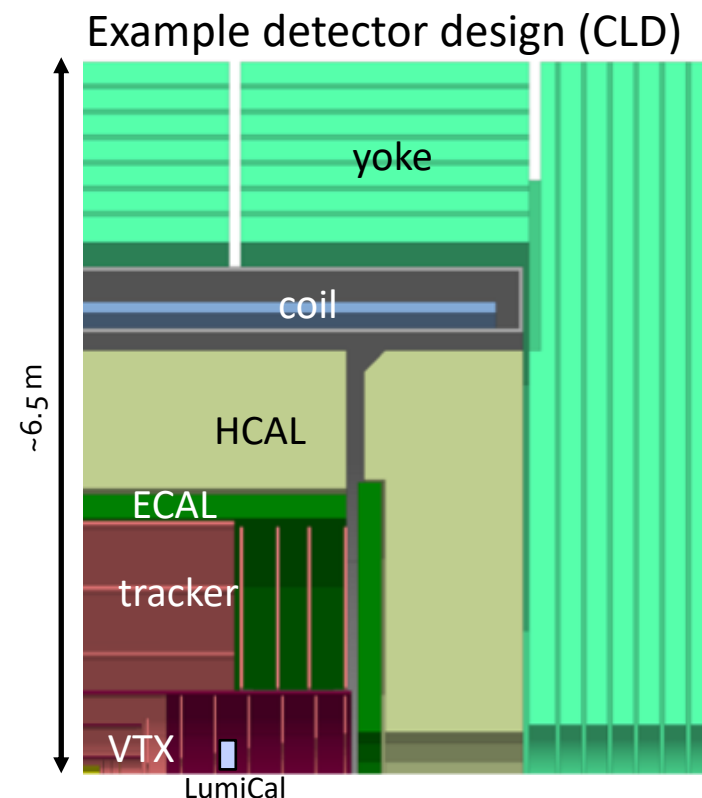
- Accept all annihilation (and normalisation) events
- Require the presence of at least one single particle candidate, charged or neutral, from one or more detector systems
 - **Calorimeters, tracker, vertex detector(?)**

In practice:

- Do we trigger on and read out every BX (20 ns) individually?
 - **ATLAS/CMS-like: Events stored in on-detector pipelines and read out at L1Accept**
 - What forms L1Accept? Need basically full detector: tracking + calorimetry
 - Where is L1 decision taken? Locally / globally?
- Or do we gang multiple BXs into one read-out?
 - **Will see increase in pile-up parameter (prob. to merge 2 events in same read-out)**
 - Mitigation via time stamping?
- Trigger-less readout?
 - **Read out full detector periodically for every n BX (frequency = $50/n$ MHz)**
 - Pile-up parameter will be $n*0.002$

Other challenge:

- On-line and off-line data reduction that will make possible analysis of $\mathcal{O}(10^{13})$ events



T/DAQ decision strongly correlated with detector design. Need to minimize power consumption (no power pulsing) and material budget for services